GM-R700

GPS Receiver User's Manual

EverMore Technology Inc.

Manual Revision History

Revision	Date	Update Summary
Issue 1.0	May 2005	Initial release
Issue 2.0	June 2005	Modify outline

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1. Introduction

1.1 Overview

EverMore series GPS module GM-R700 is a high sensitivity ultra low power consumption cost efficient, compact size; plug & play GPS module board designed for a broad spectrum of OEM system applications. This product is based on the proven technology found in 16 channel GPS receivers and NEMERIX chipset solution. The GPS module receiver will track up to 16 satellites at a time while providing fast time-to-first-fix and 1Hz navigation updates. It is far reaching capability meets the sensitivity & accuracy requirements of car navigation as well as other location-based applications, such as AVL system. Handheld navigator, PDA, pocket PC, or any battery operated navigation system.

The GM-R700 design utilizes the latest surface mount technology and high level circuit integration to achieve superior performance while minimizing dimension and power consumption. This hardware capability combined with software intelligence makes the board easy to be integrated and used in all kinds of navigation applications or products. The module communicates with application system via RS-232 level with NMEA0183 protocol.

1.2 Features

The GM-R700 GPS engine board offers following features:

- Built-in high performance NEMERIX chipset.
- Average Cold Start in 50 seconds.
- Ultra low power consumption.
- 16 channels "All-in-View" tracking.
- Support standard NMEA-0183 V3.0
- Multi-path mitigation hardware
- Optimum clock drift adjustment
- Built-in patch antenna
- On-board rechargeable battery sustained real-time clock and memory for fast satellite acquisition during power-up
- Compact board Size GM-R700 51mm x 42.5mm x 17.3mm (2.01"x1.67"x0.68") for easy integration into hand-held device.

1.3 Applications

GM-R700 engine board receiver is a high performance, ultra low power consumption, plug &play product. These applications are as follow.

- Car navigation system for portable device and car device
- Wrist watch
- Solar operated device
- Marine Navigation
- Fleet management
- AVL and location-based services
- Radar detector with GPS function
- Hand-held device for personal positioning and navigation
- Ideal for PDA, pocket PC and other computing devices at GPS application
- Asset tracking
- Timing reference

1.4 Start-up Modes

Definitions	DESCRIPTION
Cold Start	The Cold Start takes the longest startup time among EMT GPS receivers. In this scenario, the receiver has no acknowledgment on the last position, time, and satellite constellation. The receiver is initiated to search blindly for satellite signals in the cold start mode. Another situation is that when no backup battery is connected, the GPS receiver will be in the cold start mode and there is no data stored in SRAM. Execute cold start of the test tool when first use. By this way can speed up position fix time.
Warm Start	In this scenario, the receiver was off less than one week but more than 2-hour time. The receiver knows its last position, time and almanac because it has a backup battery to keep current almanac, position and time stored in SRAM. In the warm start mode, the receiver can quickly acquire satellites and get a position fix faster than it does in the cold start mode.
Hot Start	In this scenario, the receiver was off less than 2-hour time. With the back up battery connected and the current almanac, position, time and ephemeris stored in SRAM, the receiver applies its last ephemeris data to calculate and get a position fix.
Reacquisition	In the reacquisition mode, the receiver takes time to lock on satellites if buildings or obstacles are blocking the signals for a short while. This is very common in urban areas, but please be noted that reacquisition time has nothing to do with the time-to-first-fix (TTFF).

2. Technical Specifications

2.1 Electrical Characteristics

2.1.1 General

Frequency	L1, 1575.42 MHz
C/A code	1.023 MHz chip rate
Channels	16

2.1.2 Sensitivity

Tracking	-152dBm type

2.1.3 Accuracy

Position	3-25 meters CEP (90%) horizontal, SA off.
Velocity	0.1 meters/second
Time	±100 ns synchronized to GPS time

2.1.4 Datum

Default	WGS-84
Other	Support different datum by request

2.1.5 Acquisition Rate (Open sky, stationary requirements)

Hot start	7 sec, average
Warm start	38 sec, average
Cold start	50 sec, average

2.1.6 Dynamic Conditions

Altitude	18,000 meters max
Horizontal Velocity	300 kilometers/hour max
Vertical Velocity	36 kilometers/hour max
Acceleration	2g, max
Jerk	4 meters/second^3, max

2.1.7 Power

Main power input	5V ± 0.5Vp-p DC input.
Supply Current	Typical 33 mA

2.1.8 Serial Port

Electrical interface	one full duplex serial communication, RS-232 interface
Protocol message	NMEA-0183, version 3.0
Default NMEA	GGA, GSA, GSV, RMC and VTG. 9600 baud rate, 8 bits data, 1 start, 1 stop, no parity. (Option baud rate: 4800,19200, 38400)

2.2 Environmental Characteristics

Operating temperature range	-40 ℃ to +80 ℃
Storage temperature range	-50 ℃ to +90 ℃

2.3 Physical Characteristics

Dimension:	51mm x 42.5mm x 17.3mm (2.01"x1.67"x0.68")
Weight:	78g (2.75oz)
Interface connector:	PS/2 female connector

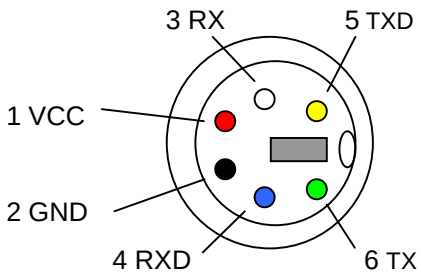
3. Hardware Interface

3.1 GM-R700 PS/2 Female Connector (standard type)

GM-R700 Real Picture

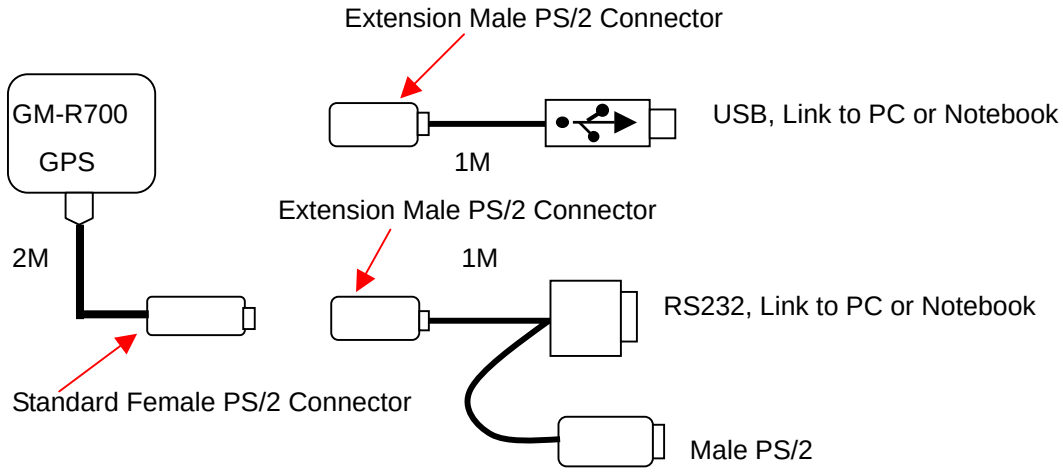
PS/2 Female Connector Pin Assignment

Pin	Function	Input/Output	Level
1	VCC	Power Supply	5V
2	GND		
3	RX	Input	12V, RS232
4	RXD	Input	3.3V, LVTTL
5	TXD	Output	3.3V, LVTTL
6	TX	Output	12V, RS232

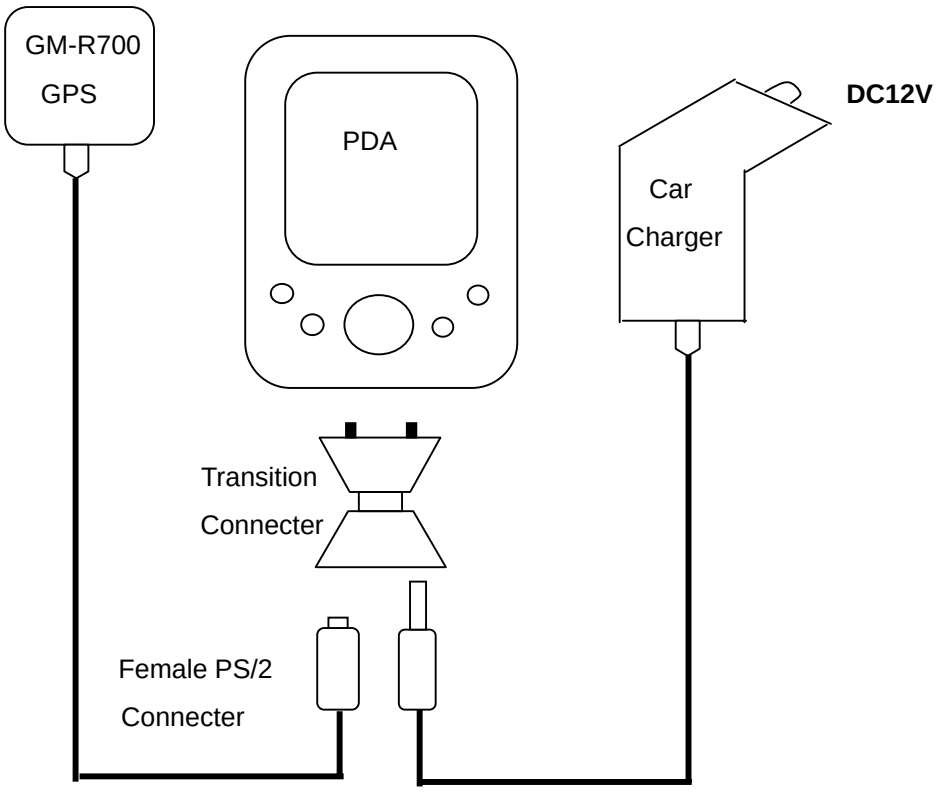


PS/2 (Female)
at the GM-R700

3.2 GM-R700 Female PS/2 Connector Interface



GM-R700 Link to Host Device Diagram



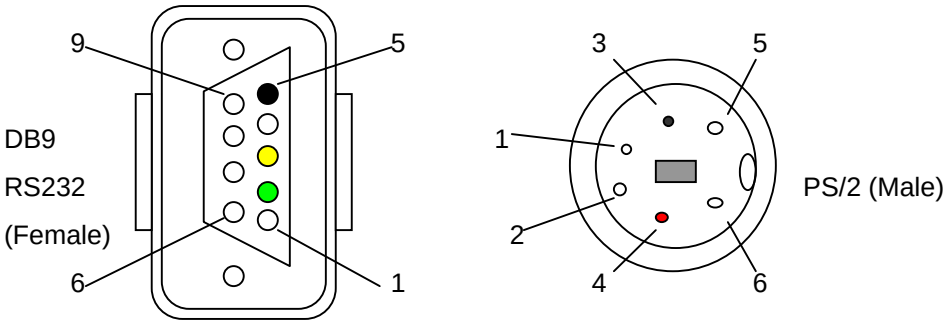
GM-R700 Link to PDA Diagram

3.3 GM-R700 Accessories

3.3.1 DB9 9 Pins Female and PS/2 Male Connector

DB9 Connector (Female)

Pin	Function	Input/Output	Level
1	NC		
2	TX	Output	RS232
3	RX	Input	RS232
4	NC		
5	GND	Ground	0V
6	NC		
7	NC		
8	NC		
9	NC		



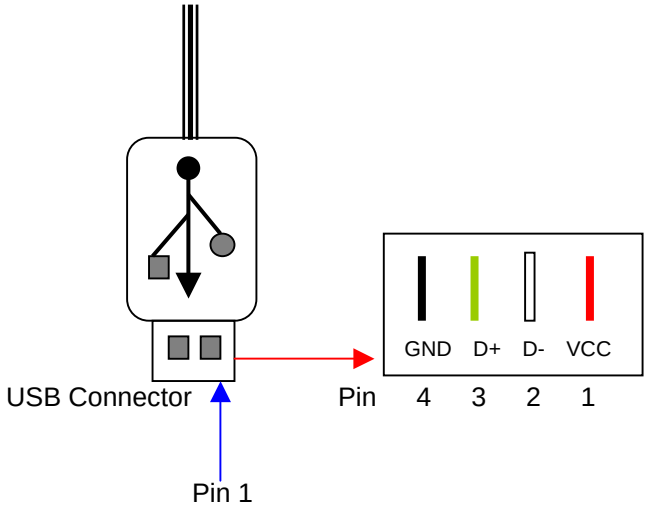
Connector Pin Assignment

PS/2 Connector (Male)

Pin	Function	Pin	Function	Pin	Function
1	NC	3	GND	5	NC
2	NC	4	VCC	6	NC

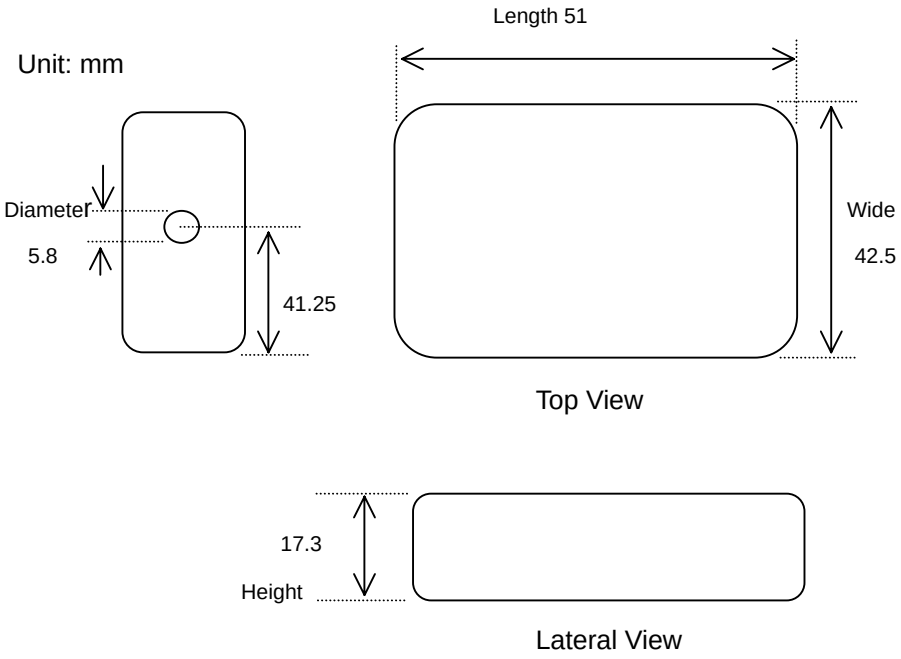
3.3.2 USB Connector

Pin	Function	Color
1	VCC, 5V	Red
2	D-	White
3	D+	Green
4	GND	Black

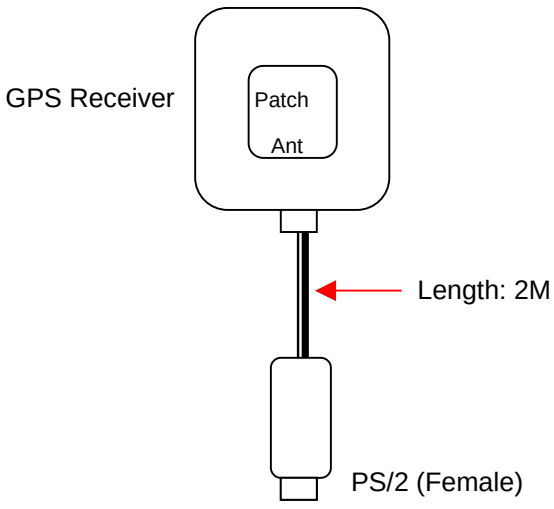


Connector Pin Assignment

3.4 GM-R700 Dimensions



3.5 GM-R700 Appearance Diagram

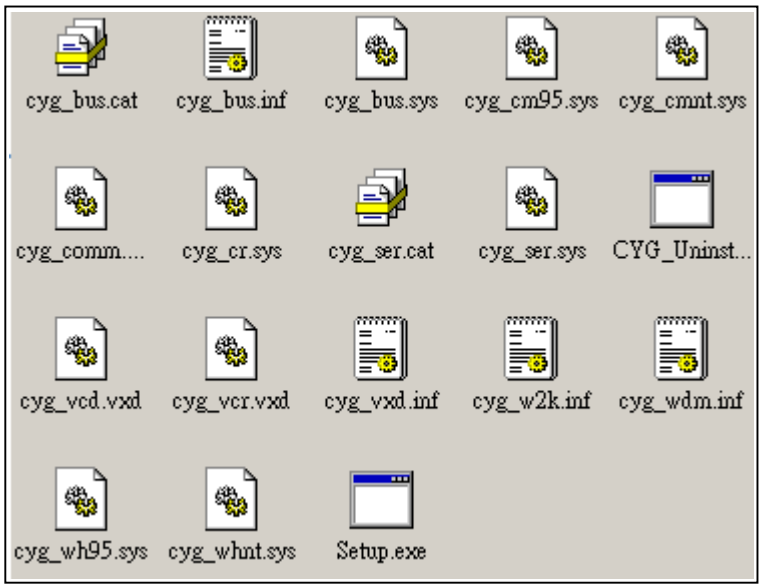


GM-R700

4 GM-R700 USB Driver Installation

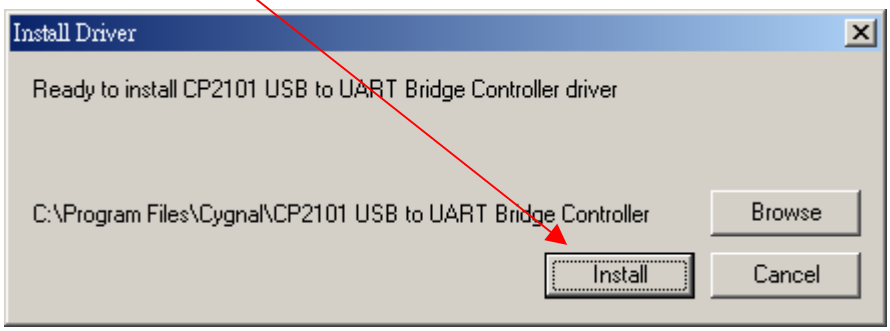
Following is the brief indication of USB driver installation. We enclose a CD for detailed USB driver installation **"GPS USB Driver Setup.pdf " with products.**

Step 1: Copy entire USB driver folder from CD to hard disk



Step 2: Double click the " Setup.exe " icon

Step 3: Press "Install" button



Step 4: Press "OK" button

Step 5: Plug-in GPS to PC USB port

Step 6: Check enables COM port number

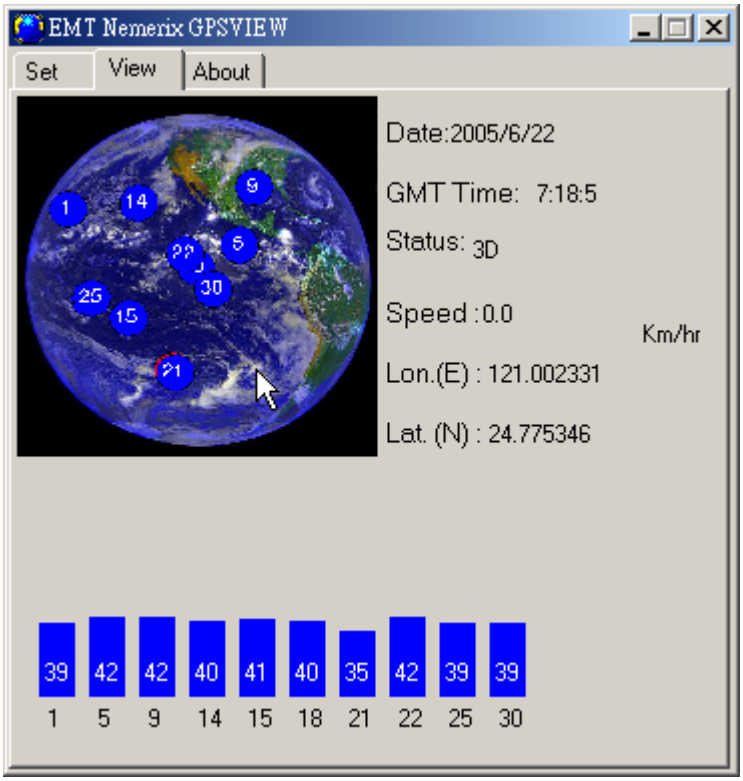
Step 7: To test GM-R700 by testing tool

5. Operation and Test

The customers can change the data protocol and communication data baud rate for your application using these tools. The software and manual are available for download from website.

Below list GM-R700 software tools

For example double click 700_SeriesGPSTest.exe to test GM-R700



6. Software Specification

6.1 GM-R700 NMEA Protocol

The GM-R700 software is capable of supporting the following NMEA message formats

NMEA Message Prefix	Format	Direction
$GPGGA(1)*	GPS fix data.	Out
$GPGLL	Geographic position Latitude / Longitude.	Out
$GPGSA(3)*	GNSS DOP and actives satellites	Out
$GPGSV(3)*	Satellites in view.	Out
$GPRMC(1)*	Recommended minimum specific GNSS data.	Out
$GPVTG(1)*	Velocity and track over ground.	Out
$GPZDA	Date and time.	Out

*: (1): 1sec output 1msg , (3): 3sec output 1msg , 9600 baud rate (Standard output)

6.2 General NMEA Format

The general NMEA format consists of an ASCII string commencing with a '$' character and terminating with a <CR><LF> sequence. NMEA standard messages commence with 'GP' then a 3-letter message identifier. The message header is followed by a comma delimited list of fields optionally terminated with a checksum consisting of an asterix '*' and a 2 digit hex value representing the checksum. There is no comma preceding the checksum field. When present, the checksum is calculated as a bitwise exclusive of the characters between the '$' and '*'. As an ASCII representation, the number of digits in each number will vary depending on the number and precision, hence the record length will vary. Certain fields may be omitted if they are not used, in which case the field position is reserved using commas to ensure correct interpretation of subsequent fields.

The tables below indicate the maximum and minimum widths of the fields to allow for buffer size allocation.

6.3 $GPGGA

This message transfers global positioning system fix data. The $GPGGA message structure is shown below:

Field	Format	Min chars	Max chars	Notes
Message ID	$GPGGA	6	6	GGA protocol header.
UTC Time	hhmmss.sss	2,2,2.3	2,2,2.3	Fix time to 1ms accuracy.
Latitude	float	3,2.4	3,2.4	Degrees * 100 + minutes.
N/S Indicator	char	1	1	N=north or S=south
Longitude	float	3,2.4	3,2.4	Degree * 100 + minutes.
E/W indicator	Char	1	1	E=east or W=west
Position Fix Indictor	Int	1	1	0: Fix not available or invalid. 1: GPS SPS mode. Fix available.
Satellites Used	Int	2	2	Number of satellites used to calculate fix.
HDOP	Float	1.1	3.1	Horizontal Dilution of Precision.
MSL Altitude	Float	1.1	5.1	Altitude above mean seal level
Units	Char	1	1	M Stands for "meters".
Geoid Separation	Int	(0) 1	4	Separation from Geoids can be blank.
Units	Char	1	1	M Stands for "meters".
Age of Differential Corrections	int	(0) 1	5	Age in seconds Blank (Null) fields when DGPS is not used.
Diff Reference Corrections	int	4	4	0000.
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

6.4 $GPGLL

This message transfers Geographic position, Latitude, Longitude, and time. The $GPGLL message structure is shown below:

Field	Format	Min chars	Max chars	Notes
Message ID	$GPGLL	6	6	GLL protocol header.
Latitude	Float	1,2.1	3,2.4	Degree * 100 + minutes.
N/S Indicator	Char	1	1	N=north or S=south.
Longitude	Float	1,2.1	3,2.4	Degree * 100 + minutes.
E/W indicator	Character	1	1	E=east or W=west.
UTC Time	hhmmss.sss	1,2,2.1	2,2,2.3	Fix time to 1ms accuracy.
Status	Char	1	1	A Data Valid. V Data invalid.
Mode Indicator	Char	1	1	A Autonomous
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR><LF>	2	2	ASCII 13, ASCII 10.

6.5 $GPGSA

This message transfers DOP and active satellites information. The $GPGSA message structure is shown below:

Field	Format	Min chars	Max chars	Notes
Message ID	$GPGSA	6	6	GSA protocol header.
Mode	Char	1	1	M➔ Manual, forced to operate in selected mode. A➔ Automatic switching between modes.
Mode	Int	1	1	1➔.Fix not available. 2➔2D position fix. 3➔3D position fix.
Satellites Used	Int	2	2	SV on channel 1.
Satellites Used	Int	2	2	SV on channel 2.
…	.	..	..	..
Satellites Used	Int	2	2	SV on channel 12.
PDOP	Float	1.1	3.1	
HDOP	Float	1.1	3.1	
VDOP	Float	1.1	3.1	
Checksum	*xx	0	3	2 digits
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10

6.6 $GPGSV

This message transfers information about satellites in view. The $GPGSV message structure is shown below. Each record contains the information for up to 4 channels, allowing up to 12 satellites in view. In the final record of the sequence the unused channel fields are left blank with commas to indicate that a field has been omitted.

Field	Format	Min chars	Max chars	Notes
Message ID	$GPGSV	6	6	GSA protocol header.
Number of messages	Int	1	1	Number of messages in the message sequence from 1 to 3.
Message number	Int	1	1	Sequence number of this message in current sequence, form 1 to 3.
Satellites in view	Int	1	2	Number of satellites currently in view.
Satellite Id	Int	2	2	Satellite vehicle 1.
Elevation	Int	1	3	Elevation of satellite in degrees.
Azimuth	Int	1	3	Azimuth of satellite in degrees.
SNR	Int	(0) 1	2	Signal to noise ration in dBHz, null if the sv is not in tracking.
Satellite Id	Int	2	2	Satellite vehicle 2.
Elevation	Int	1	3	Elevation of satellite in degrees.
Azimuth	Int	1	3	Azimuth of satellite in degrees.
SNR	Int	(0) 1	2	Signal to noise ration in dBHz, null if the sv is not in tracking.
Satellite Id	Int	2	2	Satellite vehicle 3.
Elevation	Int	1	3	Elevation of satellite in degrees.
Azimuth	Int	1	3	Azimuth of satellite in degrees.
SNR	Int	(0) 1	2	Signal to noise ration in dBHz, null if the sv is not in tracking.
Satellite Id	Int	2	2	Satellite vehicle 4.
Elevation	Int	1	3	Elevation of satellite in degrees.
Azimuth	Int	1	3	Azimuth of satellite in degrees.
SNR	Int	(0) 1	2	Signal to noise ration in dBHz, null if the sv is not in tracking.
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

6.7 $GPRMC

This message transfers recommended minimum specific GNSS data. The $GPRMC message format is shown below.

Field	Format	Min chars	Max chars	Notes
Message ID	$GPRMC	6	6	RMC protocol header.
UTC Time	hhmmss.sss	1,2,2.1	2,2,2.3	Fix time to 1ms accuracy.
Status	char	1	1	A Data Valid. V Data invalid.
Latitude	Float	1,2.1	3,2.4	Degrees * 100 + minutes.
N/S Indicator	Char	1	1	N=north or S=south.
Longitude	Float	1,2.1	3,2.4	Degrees * 100 + minutes.
E/W indicator	Char	1	1	E=east or W=west.
Speed over ground	Float	1,1	5.3	Speed over ground in knots.
Course over ground	Float	1.1	3.2	Course over ground in degrees.
Date	ddmmyy	2,2,2	2,2,2	Current date.
Magnetic variation	Blank	(0)	(0)	Not used.
E/W indicator	Blank	(0)	(0)	Not used.
Mode	Char	1	1	A Autonomous
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

6.8 $GPVTG

This message transfers Velocity, course over ground, and ground speed. The $GPVTG message format is shown below.

Field	Format	Min chars	Max chars	Notes
Message ID	$GPVTG	6	6	VTG protocol header.
Course (true)	Float	1.1	3.2	Measured heading in degrees.
Reference	Char	1	1	T = true heading.
Course (magnetic)	Float	1.1	3.2	Measured heading (blank).
Reference	Char	1	1	M = magnetic heading.
Speed	Float	1.1	4.2	Speed in knots.
Units	Char	1	1	N = knots.
Speed	Float	1.1	4.2	Speed
units	Char	1	1	K = Km/h.
Mode	Char	1	1	A Autonomous
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

6.9 $GPZDA

This message transfers UTC Time and Date. Since the latency of preparing and transferring the message is variable, and the time does not refer to a particular position fix, the second precision is reduced to 2 decimal places. The $GPZGA message format is shown below.

Field	Format	Min chars	Max chars	Notes
Message ID	$GPZDA	6	6	ZDA protocol header.
UTC time	hhmmss.ss	2,2,2.2	2,2,2.2	00000000.00 to 235959.99
UTC day	dd	2	2	01 to 31, day of month.
UTC month	mm	2	2	01 to 12.
UTC Year	yyyy	4	4	1989-9999.
Local zone hours	Int	(-)2	(-)2	Offset of local time zone (-13) to 13.
Local zone minutes	Unsigned	2	2	
Checksum	*xx	(0) 3	3	2 digits.
Message terminator	<CR> <LF>	2	2	ASCII 13, ASCII 10.

7. Limited Warranty

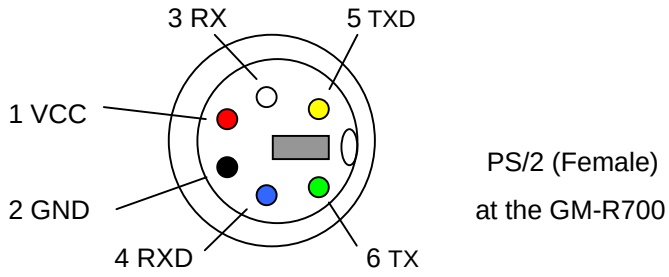
The GM-R700 is warranted to be free from defects in material and functions for one year from the date of purchase. Any failure of this product within this period under normal conditions will be replaced at no charge to the customers

8. Ordering Information

8.1 Standard Type Cable (Female PS/2)

PS/2 Female Connector Pin Assignment

Pin	Function	Input/Output	Level
1	VCC	Power Supply	5V
2	GND		
3	RX	Input	12V, RS232
4	RXD	Input	3.3V, LVTTL
5	TXD	Output	3.3V, LVTTL
6	TX	Output	12V, RS232



Female PS/2 Connectors Pin Assignment

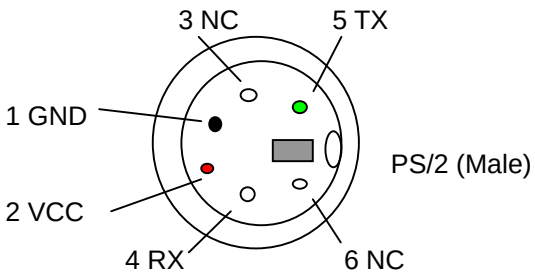
8.2 Optional Types Cable

8.2.1 Male PS/2 Cable

For all kind definition

PS/2 Connector (Male)

Pin	Function	Input/Output	Level
1	GND	Ground	0V
2	VCC	Power Supply	5V
3	RXD	Input	3.3V, LVTTL
4	RX	Input	RS232
5	TX	Output	RS232
6	TXD	Output	3.3V, LVTTL



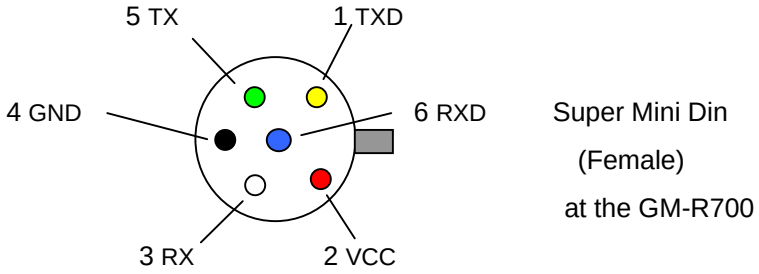
Male PS/2 Connectors Pin Assignment

8.2.2 SP6P Cable

For all kind definition

SP6P Connector (Female)

Pin	Color	Function	Input/Output	Level
1	Yellow	TXD	Output	3.3V, LVTTL
2	Red	VCC	Power Supply	5V
3	White	RX	Input	12V, RS232
4	Black	GND		0V, Ground
5	Green	TX	Output	12V, RS232
6	Blue	RXD	Input	3.3V, LVTTL



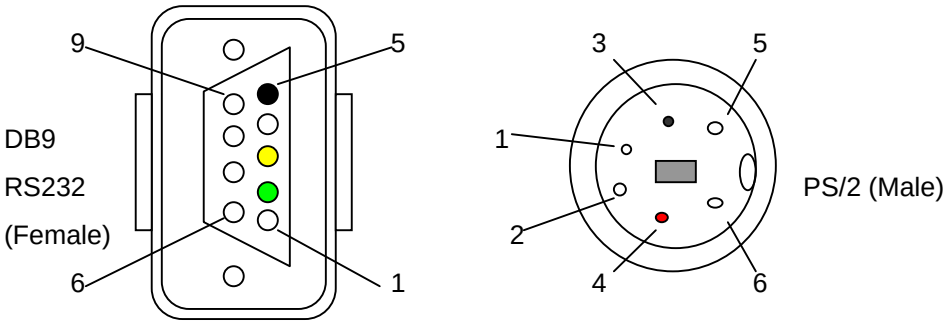
Connectors Pin Assignment

8.2.3 RS-232 Cable (DB9 9 Pins Female + PS/2 Male)

For all kind definition

DB9 Connector (Female)

Pin	Function	Input/Output	Level
1	NC		
2	TX	Output	RS232
3	RX	Input	RS232
4	NC		
5	GND	Ground	0V
6	NC		
7	NC		
8	NC		
9	NC		



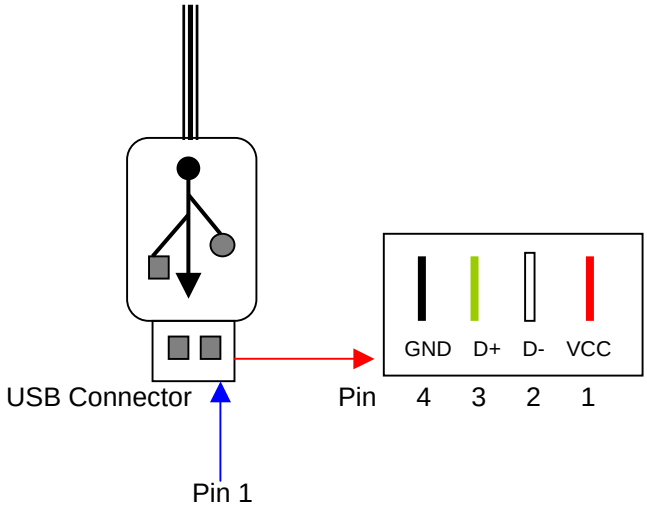
Connector Pin Assignment

PS/2 Connector (Male)

Pin	Function	Pin	Function	Pin	Function
1	NC	3	GND	5	NC
2	NC	4	VCC	6	NC

8.2.4 USB Cable (With USB Bridge Controller IC)

Pin	Function	Color
1	VCC, 5V	Red
2	D-	White
3	D+	Green
4	GND	Black



Connector Pin Assignment

8.3 Car Charger List

Input voltage: DC12V~24V, Output: 5V/2A

ITEM	Description
1	Car charger for ACER N20
2	Car charger for ACER S60
3	Car charger for ASUS A600
4	Car charger for ASUS A620 / A620BT
5	Car charger for CASIO E115
6	Car charger for CASIO E125/EM500
7	Car charger for CASIO E200
8	Car charger for DELL AXIM X3
9	Car charger for DELL AXIM X5
10	Car charger for Eten P300 / M500
11	Car charger for HP Jonada
12	Car charger for IPAQ iPAQ 38xx/39xx/22xx/4x/5x/Rx/RZ/Hx serial
13	Car charger for IPAQ 36XX/37XX
14	Car charger for Mitac Mio 338/528/558
15	Car charger for NEC
16	Car charger for PALM 500/505/T3
17	Car charger for PALM Vx
18	Car charger for Siemens Loox
19	Car charger for SONY Nxx Series
20	Car charger for SONY Txx
21	Car charger for Toshiba E330/E740
22	Car charger for Toshiba E400
23	Car charger for Toshiba E570
24	Car charger for Toshiba E800
25	Car charger for XDA/T-Mobile MDA
26	Car charger for XDA-II/T-Mobile MDA
27	Car charger for Yakumo Delta 300
28	Car charger for Yakumo Omnikron
29	Car charger for Anex TEK SP230
30	Car charger for Acer N30/N35/N50
31	Car charger for Dell Axim X50V/X50
32	Car charger for ASUS A716 / A730 / A730W / P505
33	Car charger for Palm T5 / Treo 650/Tungsten E2

9. Series Products Information

- **300 Series for Evermore BBP1202 Chipset:**
  1: GM-307 (USB G-Mouse)
- **500 Series for Evermore BBP1202 Chipset:**
  1: GM-M500 (G-Mouse Module)
  2: BT-R500 (Bluetooth GPS)
  3: GM-R500 (G-MOUSE)
  4: CF-R500 (CF Card GPS)
  5: GM-R500-DL (Data logger)
  6: GM-R507 (USB G-Mouse)
  7: CM-M500 (GPS Module)
  8: DL-200 (Data logger)
- **600 Series for Himark AR2010 Chipset:**
  1: CM-M600B (GPS Module)
- **700 Series for Nemerix NJ1030 Chipset:**
  1: EB-N700 (Engine Board, with patch antenna)
  2: EB-N701 (Engine Board, without patch antenna)
  3: BT-R700 (Bluetooth GPS Type I)
  4: BT-R750 (Bluetooth GPS Type II)
  5: GM-R700 (G-Mouse)

10. Appendix

EverMore Website

Welcome to EverMore website at http://www.emt.com.tw or http://www.globalsources.com/gpsevermore.co for updated product information and drivers download.